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**THE FISHERIES OF
THE SCOTTSHEAD/SOUFRIERE
MARINE RESERVE
(DOMINICA)**

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1. Introduction

The Scotts Head/Soufriere Bay located in the south of the island of Dominica, has attracted the attention of many people over the years. In this unique area exists an environment for recreation, swimming, snorkelling, scuba diving and fishing. As a result the environment is favourable for the development of tourism among other uses. In recent times there has been an increase in the demand for use of the marine space within the bay. Dive tourism has increased, the number of dive operators and the incidence of yachts anchoring on the coral reef has also increased along with the number of swimmers and visitors seeking leisure and recreation. These activities have interfered with traditional fishing operations. This then posed the problem of user conflict within the bay. It therefore, became necessary to declare the area a Marine Reserve which was named the Scotts Head/Soufriere Marine Reserve (SSMR). It extends from a reference point on the top of the tip of the Scotts Head peninsula to another land based survey control point at Point Guigard totalling three kilometers of coast line. The control points were established by personnel of the Lands and Surveys Division.

The Fisheries Division later embarked upon the zonation of the area in order to minimize user conflicts and to allow the social and economic activities to occur within the bay without too much difficulty (Fig. 1). Consequently the bay was divided into a recreational area for snorkelling and swimming, a scuba dive area, a nursery area where juvenile fish are found and no fishing or scuba diving is permitted, and the largest zone being a fishing priority area where fishermen conduct their activities without too much interference from the other users of the bay.

The villages of Scotts Head and Soufriere are predominantly fishing villages and have for many years been the traditional users of the fishery resources of the bay. The soil type and terrain of the Scotts Head area is not conducive to agricultural production and consequently the villagers have always looked to the sea for their livelihood, both within the bay and beyond. Fishing is therefore their main economic activity. Owing to its artisanal nature, the entire community thrives around the fishing activity and as a result the fishermen has meshed into the socio-economic life style of the villages.

Over many years a significant amount of fishing activity has taken place and still continues to occur within the bay. Various kinds of fish resource, both pelagic and demersal, are used by the fishermen, and are exploited with a variety of fishing gear. Visual studies in the area tends to indicate that there is a reduction in the size and quantities of demersal species landed. However no scientific study has been done in that regard. This paper presents a scientific analysis of the catch and effort data collected on fishing activity within the reserve over a period of eighteen months. The results are presented along with recommendations for further studies to be done and some points for consideration in the development of a management system which will address the issue of user conflicts as well as that of responsible fishing for the conservation of the resource and protection of the habitat. The paper also seeks to determine the importance of the bay to the fishermen of the Scotts Head/Soufriere area and hence their place in any management program for the SSMR.

PHYSICAL CHARACTERISTICS OF THE SEA BED IN SSMR

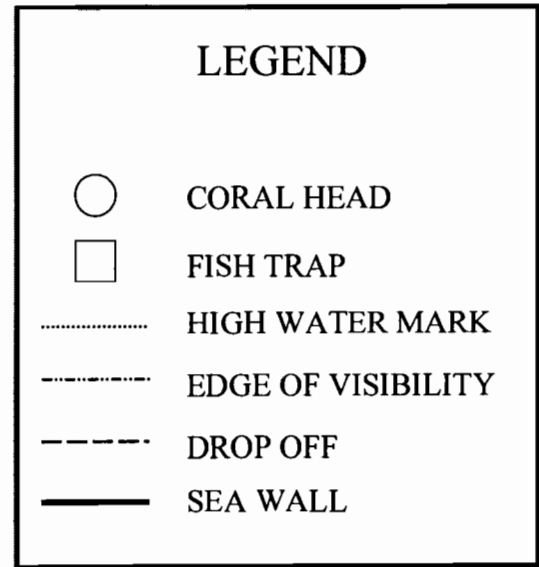
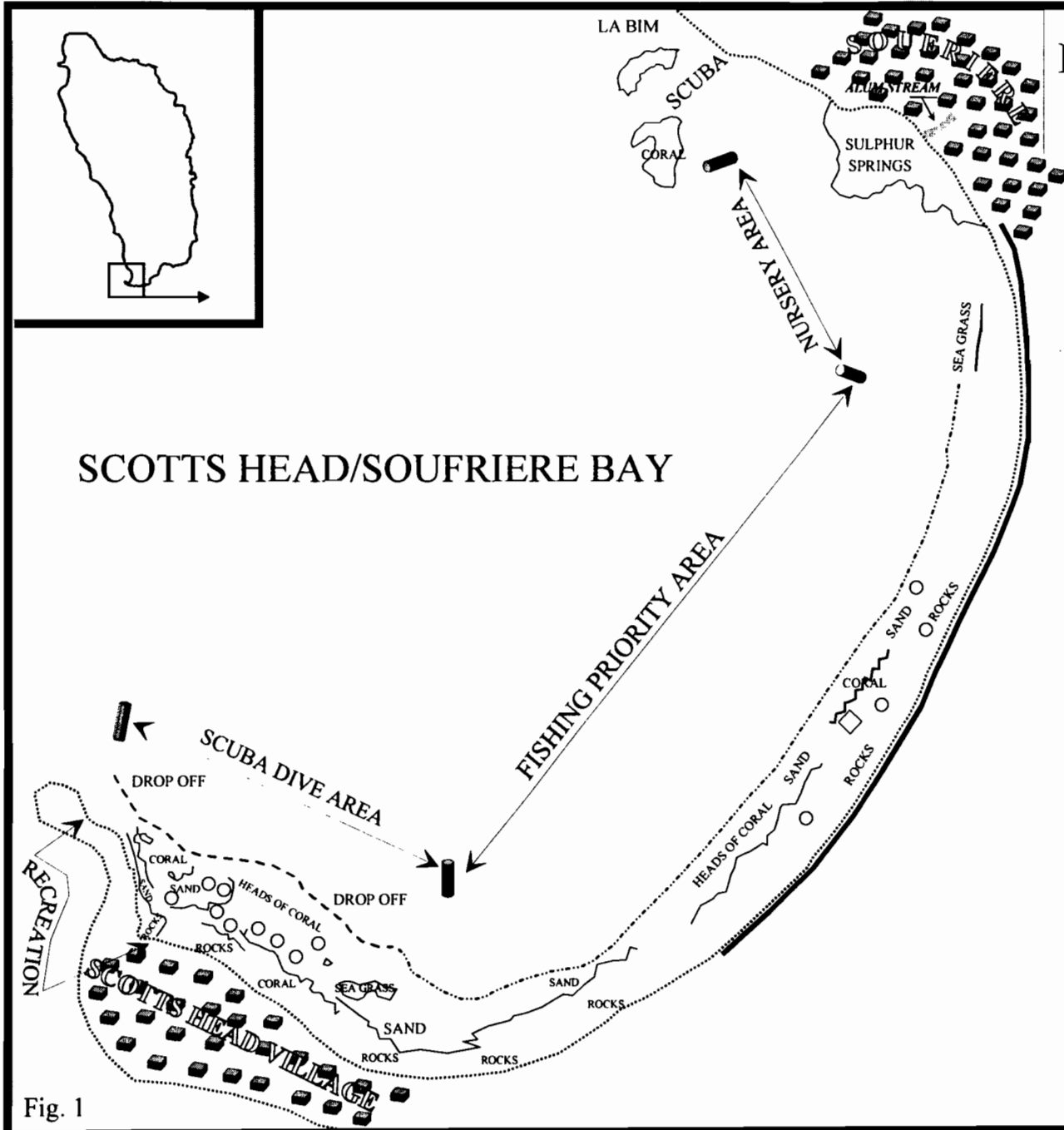


Fig. 1

2. Characteristics of the Scotts Head/Soufriere marine reserve

The Fisheries Division together with a group of survey students from the University of East London conducted a study to provide information on the physical characteristics of the area including bathymetry, visual habitat studies, percentage live and dead coral, algae, human impact, aesthetic rating, and snorkelling and diving potential. As a result a map of the area was produced indicating the features of the substratum and of the waters occupied by the marine reserve (Fig. 2).

The shelf is made of a steep slope extending from the mean high water mark to a sharp drop off (point of invisibility) located at a depth ranging from 10.6 m to 15 m and down to 18 m in the Soufriere area ; the insular shelf is therefore rather narrow. Coral reef communities and a diversity of fish species, molluscs and other marine invertebrates thrive in the area.

West of the Scotts Head peninsula is located one of the most attractive areas of the bay -Trou Sable. The data available indicates that there is a sandy beach with fringing coral reef. Percentage dead coral and algal growth were found to be negligible, human impact 5%, and snorkelling/diving potential and aesthetic rating excellent, in excess of 95%. This area was demarcated as the recreational area. The coral reef continues to about 15 m and then the sea bed drops vertically downwards manifesting into a wall of coral, sponges, sea fans and other marine organisms admired by scuba divers. This area has been demarcated as a scuba diving area.

Adjacent to the length of the village of Scotts Head a fairly large population of fish species was recorded, up to 45% algal growth in some areas, coral reefs and scattered coral heads on a sandy bottom forming the greater part of the substrate in this section of the bay. Human impact was estimated as 90%, snorkelling and scuba diving potential low and aesthetic rating less than 20%. This area constitutes the southern demarcation zone of the fishing priority area. Adjacent to the northern extremity of the village of Scotts Head exists a sea grass bed with the substrate getting sandy towards the edge of visibility on the westward side and manifesting into coral heads and boulders towards the shore line. This characteristic of the sea bed continues northwards up to 40 m of the village of Soufriere. The shoreline in this part of the bay is also very narrow with only about 1-2 m between the mean high water mark and the existing sea wall. At high tide the waves crash against the sea wall. In this rather wide section of the marine reserve 25% to 30% of dead coral and coral rubble was recorded, with 10% algal growth cover, a fair abundance of juvenile fish, two lobsters, few adult size reef fish ; human impact was estimated as 50- 70%, snorkelling/diving potential and aesthetic ratings of 50%. This area has been demarcated as the fishing priority area, with the northern demarcation zone being 20m short of the village of Soufriere.

Towards the northern extremity of the fishing priority area is the Soufriere beach. The sea bed narrows as the depth increases sharply to 18 m. On this narrow submarine ledge is a small sea grass bed, a predominantly sandy bottom with coral heads and a small reef to the right of the Alum stream. In this general area numerous hot gas bubbles produced from volcanic activity escape from the ocean floor through the water column and to the surface. The temperature of the substratum and surrounding waters is slightly

elevated and an abundance of post larval and juvenile fish occurs in this area. It has been demarcated as a nursery area. Coral cover was 40%, algal growth rather high at 65%, human impact 95%, snorkelling and diving potential and aesthetic ratings less than 40%. North of Soufriere village is « Labim » with very good coral cover, many fish species, good snorkelling/diving potential and an aesthetic rating in excess of 85%. This area was also demarcated for scuba diving.

3. Methodology of data collection and processing

The Fisheries Division of Dominica initiated in 1992 the collection of fishery data within the SSMR area, in order to reach a better knowledge of the extent of the activities which could possibly be impacted upon by the project. A full-time data collector was especially hired for this purpose, whose task was to record information on any fishing trips conducted within the boundaries of the SSMR area. The principles of this particular operation were basically the same as for the routine collection of statistical data conducted by the Fisheries Division in the landing sites of Dominica, but some specific additional requirements were imposed :

- recording of the fishing trips occurring in the SSMR area only
- with particular exceptions, exhaustive recording of these trips
- species catch composition as detailed as possible
- recording the registration number of the boats, when available

The stats collector was expected to collect data from the two landing sites of the SSMR area, Scotts Head and Soufriere, which are about 2 km apart with frequent possibilities of transport between them. Most of the fishing activity takes place from Scotts Head, where the data collector actually lived, close to the sea. Since only a part of the total fishing activity of the villages took place within the SSMR area, an exhaustive recording was most often possible ; however, when one boat could not be recorded directly, the data were obtained later by interview with the fisherman. Data were collected every day, except on Sundays where almost no fishing activity occurs. The data collected for each fishing trip were the following : date, registration number, use of an engine, gear, area fished, time spent at sea, catch of each species caught (57 species or groups of species), total catch. The field work took place between October 1992 and March 1994, and 1294 fishing trips were recorded.

Although no formal assessment can be made, various considerations lead to the conclusion that the data collected are fairly reliable. The data collector was hired for this task and received a specific training with the Fisheries Officers about the various aspects of the data collection. As a member of the Scotts Head fishing community, she had good relations with the fishermen and was accepted by them, so that no bias on fishing activity data can be suspected. Gear recording was often made according to the indications of fishermen, and thus sometimes reflected different ways of naming the same gear, but this was corrected later on the computer files, after checking with the data collector. In addition to the initial training, she was given a species identification guide, and in several occasions took pictures of fishes of uncertain identification to check with the Fisheries Officers. However the fish species are so many in the Caribbean (especially reef fishes), and sometimes so difficult to distinguish on the field by a non-specialist, that the catch composition data should not be considered as accurate as if they had been recorded by

trained biologists in a specialized research program. As in the other landing sites of Dominica, the estimation of catch weight was done visually and was often based on the number and size of the containers used to store the catch ; field checks conducted as part of the CFRAMP Project showed that no significant bias occurred by using this method.

Monthly estimates of number of trips were obtained for each gear by raising the average daily number of trips to the number of days of the month excluding Sundays ; catch/trip was obtained monthly by a simple average of the catches recorded for each gear, and monthly landings by species and by gear were estimated from number of trips and average catch/trip.

4. General description of fishing activities within the SSMR area

4.1. Fish resources of the bay and fishing techniques used

By its geographical and bathymetric features, the Soufriere/Scotts Head Bay is a unique environment where various marine ecosystems coexist within a small space :

- the shelf itself with various habitats according to the nature of the substrate : sand, rocks, corals, sea grass beds, etc. The demersal fishery resource (snappers, groupers, parrotfishes, grunts, squirrelfishes, lobsters, etc.) is exploited with pots, gillnets, and lines. The main kinds of pots used in the SSMR area are the traditional Z traps which are unbaited and hauled after a few days, catching the whole range of reef fish and crustacean species, and the « tombé-levé » pots which are smaller, baited with fish or octopus, and hauled several times per trip to catch mainly carnivorous species such as groupers (coney, red hind) and morays. The bottom nets used in SSMR area are gillnets (trammel nets are not allowed) set for a few hours to catch various fish species and lobsters, among which are grunts, snappers, and sometimes sharks. Lines are used either as hand lines or bottom longlines, targeting mainly carnivorous species ; this is the only gear which can catch deeper fish species (especially snappers), where depth and slope steepness make it impossible to use pots or nets.

- small species aggregate in schools in the water mass close to the shore, live either near to the surface or in the water column, and feed mostly on plankton. The most important species of this coastal pelagic resource are ballyhoo, small carangids (mackerel, jacks or couliwou), and sprats. Although surface gillnets can be used, the main gears in this fishery are beach seines, which are normally hauled from the shore, but can sometimes be used in deeper waters if the schools of fish are too far from shore ; in this case, fishermen dive to close the net from below, to prevent the fish from escaping.

- the water mass further offshore, part of the oceanic ecosystem, whose fish species usually lives in the open water far from land, but can come very close to shore in this deep bay : tunas and bonitos are sometimes caught within the bay. This offshore pelagic resource is fished with trolling lines and flyingfish surface gillnets.

4.2. General structure of the fishery

Seven different types of fishing gear used in various combinations and methods are operated within the SSMR. In absolute numbers, 1023 trips were done during the whole year 1993, corresponding to a production of 36818 lbs. The fishery is predominantly

devoted to the catch of coastal pelagic species : this component accounts for more than half of the trips, and about 90 % of the landings, both in weight and in value (Fig. 3).

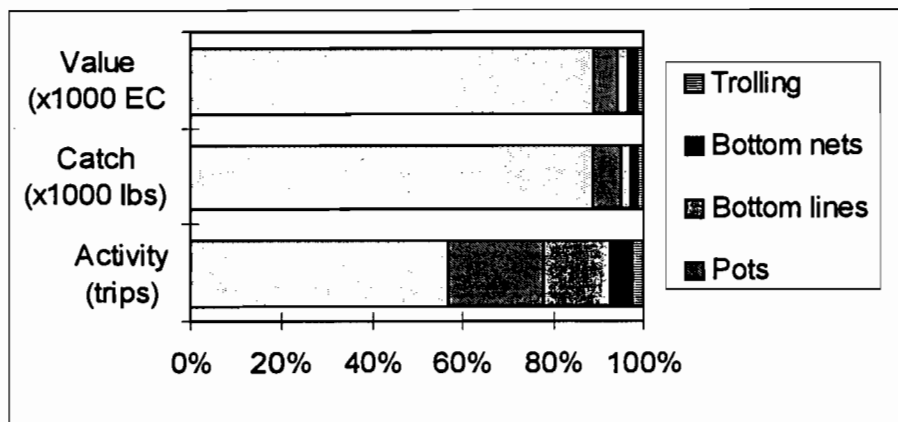


Figure 3. General structure of the SSMR fishery

4.3. Monthly fishing activity

The estimated number of trip by gear type indicates that the beach seine is the most commonly utilised gear with no distinct seasonality of use, targeting coastal pelagic species. It is used throughout the year with activity ranging from 16 to 94 trips and as high as 105 trips per month in August of 1993 (Fig. 4).

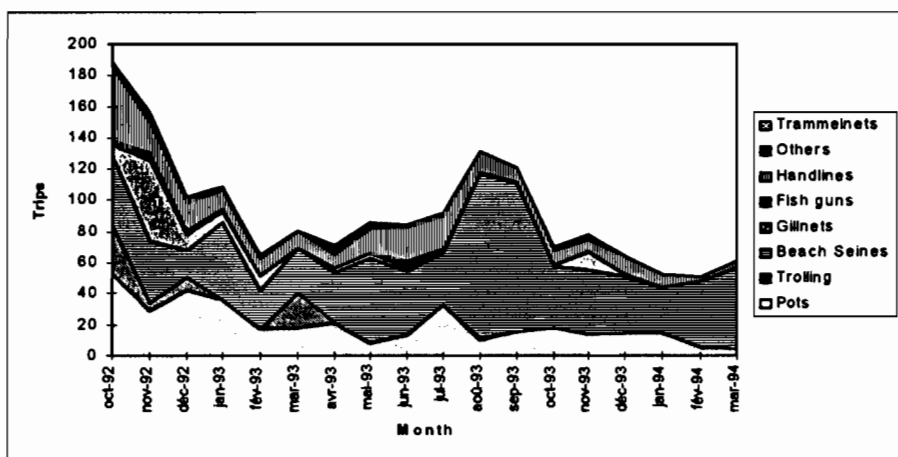


Figure 4. Monthly fishing activity in the SSMR area

Fish pots are the second most utilised gear followed by hand lines which target the demersal reef species. The pot fishing activity ranges from as low as 4 to 5 trips per month during the peak pelagic season to as many as 53 trips in the off season in October of 1992. The sharp decrease in activity after January 1994_for both gear types could be due to the effect of pelagic fishing activity coupled with reduced sampling by the stats collector due to administrative financial difficulties.

Gillnets are operated on a rather small scale with activity being generally low at 1 to 3 trips per month for the greater part of 1993 and zero for the month of March 1993 as well

as for the first three months of 1994. There is a noticeable increase in November of 1992 and 1993 of 51 and 12 trips respectively, corresponding with the pelagic off season. Some trolling is done with highest activity recorded on November 1992 and March 1993 at 31 and 22 trips respectively. The great variance between these high activity periods and the rest of 1993 to March 1994, indicates that generally trolling within the bay is a sporadic activity but not an established fishery in the reserve.

Spear guns and trammel nets are not used to any significant proportion and are therefore not of any great importance. The activity recorded as 'others' was also considered as being insignificant owing to the small number of trips observed. This category constitutes unrecorded gear types within the data set.

4.4. Average catch per trip by gear type

The average catch of beach seines was 60.80 lbs/trip over the whole period, with wide monthly variations (from 20 to 120 lbs/trip) reflecting the natural variability in abundance and availability of this schooling pelagic resource (Fig. 5)

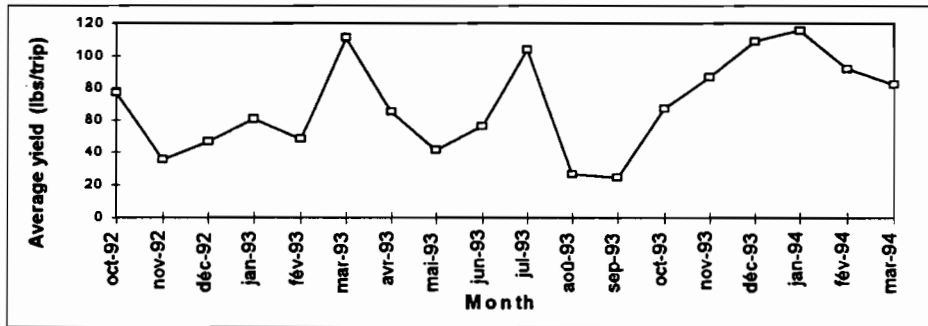


Figure 5. Monthly average catch/trip for the beach seine fishery

For gillnets the average catch was 20.34 lbs/trip ; it is often much lower (less than 10 lbs), but the average is partly determined by the large value obtained in May 1993, as the result of one large shark caught during that month (Fig. 6). No gillnet fishing was done for the month of March 1993.

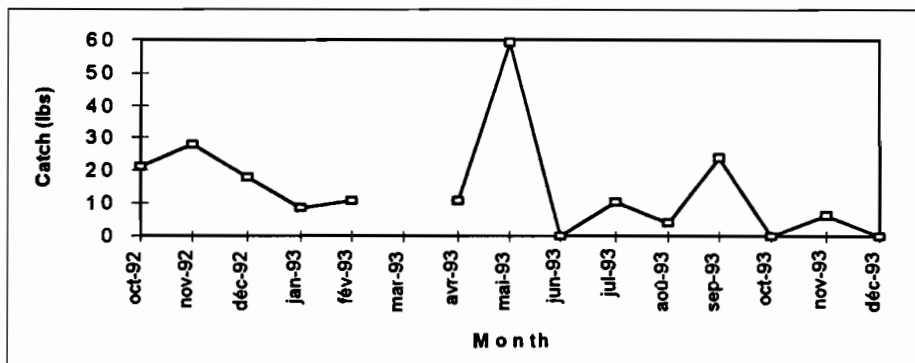


Figure 6. Monthly average catch/trip for the bottom gillnet fishery

For hand lines the average catch per trip was 5.07 lbs (Fig. 7). The low average catch by comparison with the gill nets considering the sample sizes is due to the different modes of operation and area covered by one gear versus the other, hence greater fishing efficiency of the gill net and the greater selectivity of the hook and line gear.

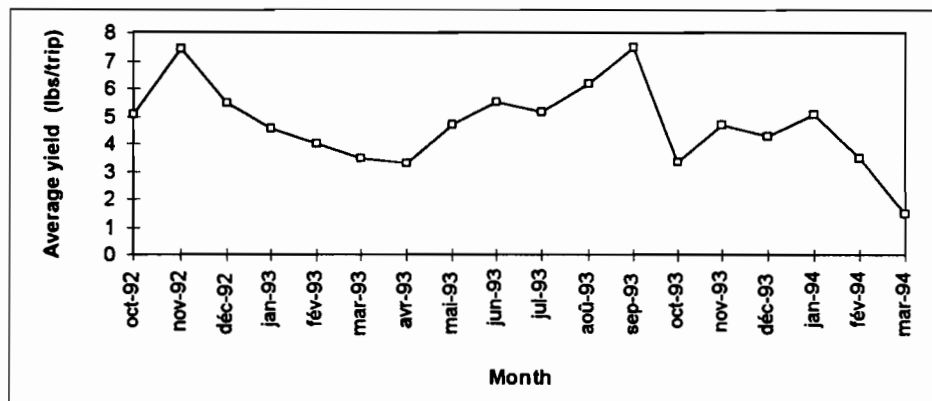


Figure 7. Monthly catch/trip of the hand line fishery

The average catch per trip for pots was 11.36 lbs. No indication was given of the numbers, sizes or soak times of the traps used in the bay (Fig. 8). The troll gear also shows a low catch rate of 5.7 lbs, standard deviation of 7.13 and n= 53. The low level of activity recorded for the Trammel net and the spear gun does not warrant too much importance.

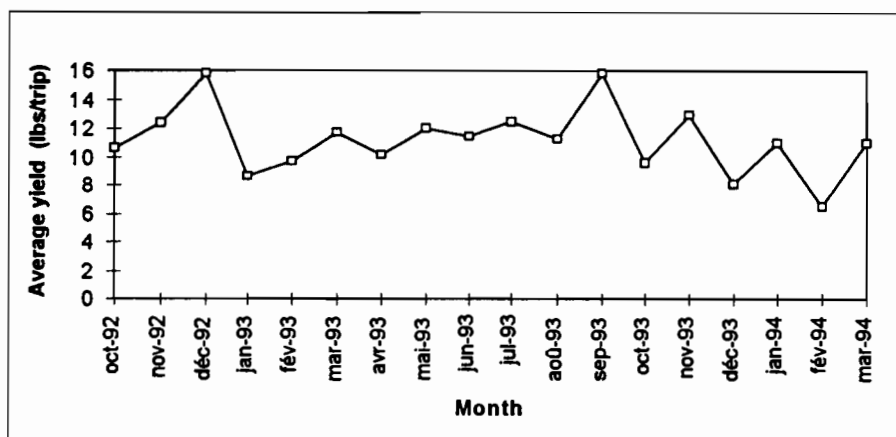


Figure 8. Monthly catch/trip of the pot fishery

4.5. Fish production

The total estimated catch by predominantly used gear types i.e. beach seine and pots for the 18 months period was 50,049 lbs and 4,193 lbs respectively (Fig. 9). The estimated monthly landings show that the beach seine yielded as much as 4,340 lbs of fish in March of 1994. Pots yielded up to 358 lbs in November of 1992. Beach seines contributed 87% of the total landings for 1993 and pots 6%. The other 7% was contributed by trolls, spear guns, trammel nets and the 'other' gear category.

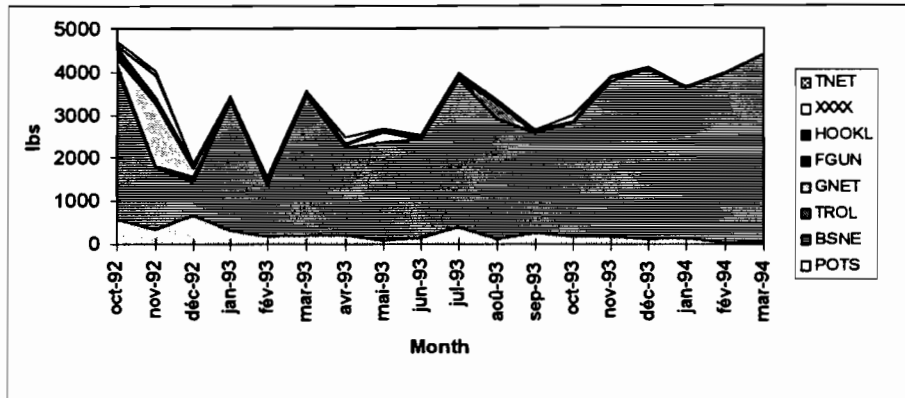


Figure 9. Monthly landings in the SSMR area

The estimated production obtained from all gear targeting demersal species was 8,150 lbs from 576 trips for the sampled period. By comparison with beach seines where 50,049 lbs was produced from 619 trips, the results indicate that 49% of the total fishing effort from beach seine produced 83.6% of the total landings and 45% of the effort on the demersal fishery produced only 13% of the total landings for the sampled period. The total estimated production for 1993 was 37,204 lbs with beach seine contributing 32,679 lbs and pots 2,374 lbs.

4.6. Average catch composition by gear type

Mackerel is the most abundant species caught by beach seines; it forms about 1/3 of the catch followed by ballyhoo and then bonito. Other species caught are sprats, jacks and cavalli (Fig. 10). The most common species caught with spear guns are octopus and parrot fishes along with several other reef species and some coastal pelagic species as well. An almost equal proportion of morays, coney, squirrelfishes and graysby are caught by pots (Fig. 10). The proportion categorised as others most likely included those species described above as well as other reef species. The presence of ballyhoo in pots is most probably related to its use as baits rather than a regular species of the pot fishery.

The most commonly caught species from trolling are bonito and skipjack. For hand lines and gillnets the most common species caught are snappers and pespine (white grunt) respectively. Only a small proportion of snappers are caught by gillnets whereas no pespine are caught with hook and line indicating that the gear is species selective (Fig. 10).

5. Distribution of fishing activity among fishermen

Trip-by-trip recording of boat registration numbers provide useful information on individual fishing patterns. This has not always been possible as some boats have no identification, either because the registration process was not yet completed in this area, or because the number had been painted over during repair works and not replaced. In summary, 825 trips out of 1294 (63.7 %) have been recorded with a boat registration number, and 47 different boats were identified ; the remaining 469 trips were done by an unknown number of different boats. The data of a previous census done in the late eighties (13 boats in Soufriere and 106 in Scotts Head) are now outdated but provide an order of

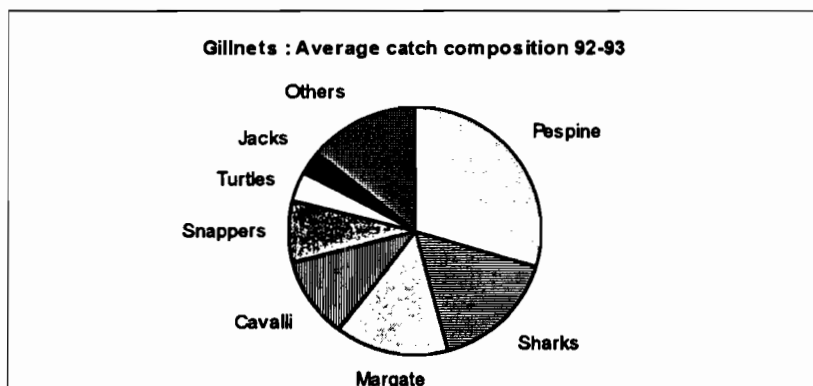
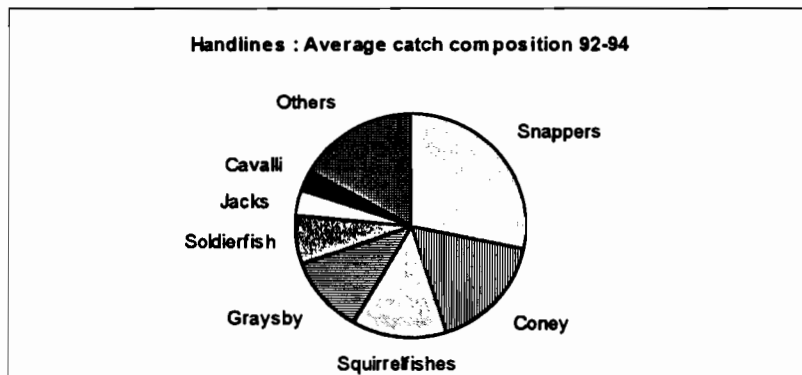
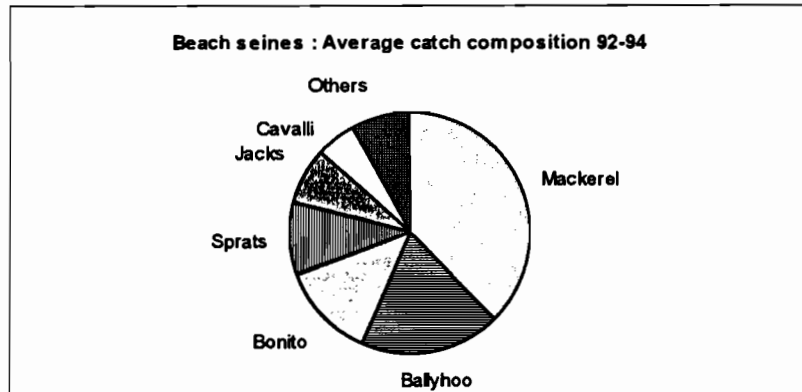
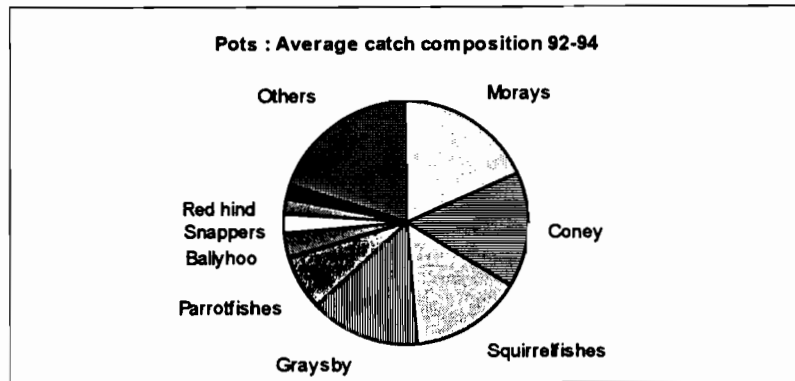


Figure 10. Average catch composition by gear

magnitude of the size of the fishing fleet in the two villages, a low proportion of which seems to be involved in fishing activities within the SSMR area.

Further information is obtained from the distribution of individual number of trips (Fig. 11). There is a continuous decrease of activity from the most to the less active boats (from 73 trips to 1 trip over the whole period), without a clear-cut gap between them. Therefore the fishing activity in the SSMR area cannot be said to be conducted by a small, easily identifiable, part of the local fleet ; this is reflected by the smooth aspect of the concentration curve, which shows that the 8 most active boats account for half of the activity, but that the remaining half involves 39 different boats.

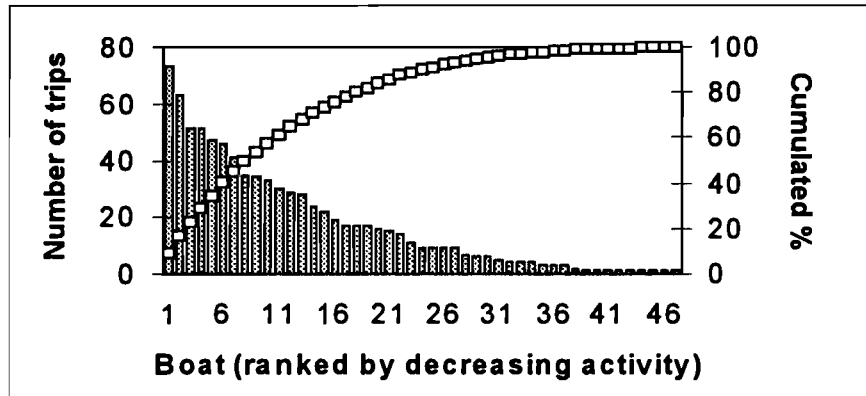


Figure 11. Individual boat activity in SSMR area

Individual numbers of trips within the SSMR are low compared to the number of days sampled (357 over 18 months) : the most active boat fished only on 20.4 % of the days, and only 16 boats fished on more than 5 % of the days. Besides a possible under-reporting of registration numbers (which would not have significantly increased these rates), two reasons can explain these seemingly surprising results. The first one is the general part-time nature of the fishing activity in Dominica, where about 55 % of the fishermen also rely on another activity for their living ; therefore one should not expect very high fishing activity rates in this artisanal fishery. The second one is that the rates observed here reflect only a part of the fishing activity in Scotts Head and Soufriere since, in addition to the SSMR area, these fishermen also fish in other coastal areas (north of Soufriere), and especially in the offshore waters where the migratory pelagic species are actively seeked during a part of the year. These latter trips were not covered by the data collection system, but the data available for neighbouring sites shows that they account for about half of the annual fishing activity.

Several gears are used to fish within the SSMR area, but do not seem to be used by the same fishermen, as shown by the activity patterns of the 23 most active ones (defined here by 10 trips or more and accounting together for 56.6 % of the total activity). Out of this subset, 15 can be considered as monoactive (M on fig. 12) and use one gear almost exclusively, i.e. in more than 90 % of their trips : 10 use beach seines, 4 use pots and one uses gillnets. The activity of 4 fishermen (D on fig. 12) is dominated by one gear which accounts for 70 to 90 % of their trips (beach seine for 3 of them, pots and gillnets for one each), but also use one or several other gears in non-negligible proportions. The remaining 3 fishermen are really polyactive (P on fig. 12) as no gear accounts for more than 70 % of

their activity. On the average, the fishermen who use exclusively one gear go fishing more often than the others : there is a statistically significant difference between the number of trips done on the average during the whole period by the 15 monoactive fishermen (37.9 trips/fisherman) and by the 8 more polyactive ones (20.6 trips).

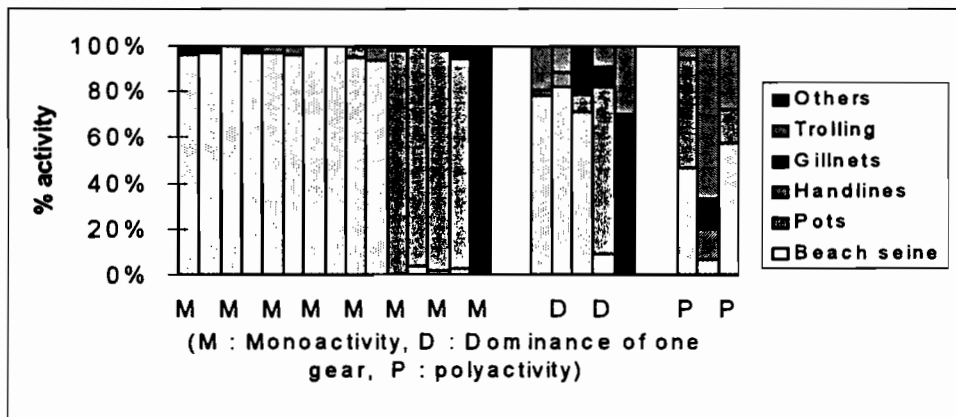


Figure 12. Individual polyactivity patterns

6. Conclusions and recommendations

This study allows for the first time an objective and quantitative description of the fishing activities within the Scotts Head/ Soufriere Marine Reserve. Although much information is still incomplete or even lacking (especially as far as socio-economics is concerned), this analysis provides useful elements in the view of management decision-making. In developing a management plan for the Scotts Head/ Soufriere Marine Reserve, an area where there exists multiple uses of the same natural resource, it is important that the resource be allocated both within and between uses. The main issues where fishing activity is involved are : management of the fishery resources, management of the habitats, dependence of the fishermen on the Marine Reserve, user conflicts.

6.1 Management of the fishery resource

A fishery management system aimed at addressing and conserving the integrity of the fish stocks must be integrated into environmental management schemes for the area ; this is particularly important as the area at issue constitutes a coastal zone with two fringing coastal communities. Management approaches should involve dialogue and discussion with the parties concerned and guidelines must be drawn up to be followed by all parties involved in the exploitation of the resources in its various forms.

Being the dominant activity and in part providing a livelihood for the fishermen of the area, it can be expected that fishermen will maximize their efforts at the beach seine fishery and that some form of management is therefore necessary. The time span over which data was available was not sufficient to allow trends in the fishery to be noticed and therefore there is no indication of whether or not this fishery is in trouble. However a precautionary approach should be exercised to ensure that the species at issue should at least be sexually mature at the time of first capture. If necessary, management of the coastal

pelagic fishery resources within the bay may not be effective unless it is done on a national level by putting size limits to the various species

The output obtained from the data on the demersal fishery are insufficient to lead to any indication of the productive potential of the shelf nor of the exploitation status of the fish stocks. The yields obtained in this fishery (5 to 20 lbs/trip according to the gear) are very low compared to those of the coastal pelagic fishery (about 60 lbs/trip) ; although this comparison may have an economic interest (taking into account the specific costs and fish price for each one), it cannot be used in terms of fish stock assessment as the abundance, ecology and behaviour of the two resources are very different. However some qualitative elements of assessment can be stated for the demersal fish resource of SSMR area : the first one is that the shelf is very narrow and thus this area cannot biologically support a large demersal fish population : this should not lead to expect high catches. The second one is that both scuba diving censuses and fishery data collection showed the predominance of small-sized fish, with low densities observed underwater, and thus suggest that the resource is already subjected to a high fishing pressure (although this pressure cannot be quantified at the moment).

6.2. Management of the habitat

Habitat management is the preservation of the living and non living cover of the bottom, and of the various uses it may have by human activities. This may include the impact on reef organisms of scuba divers, of yacht anchoring, of fishing gears, of siltation due to land operations, etc. In this report only the interaction of habitat management with fishing operations is relevant. In the SSMR area, beach seines, bottom nets and pots may have a destructive action on benthic organisms. Beach seines are hauled towards the beach, and thus may exert some negative effect on the bottom by the dragging action of the leadline ; however this effect is probably of minor importance because the sandy areas where it is preferably cast (to avoid damaging the net with rocks) have a very poor benthic fauna. Bottom nets (and especially trammels) are known to dislodge parts of corals, gorgonians, sponges, etc., when hauled from the boat. The potential effect of pots is different : when they fall on the bottom, their own weight can break these organisms, and when hauled they often move on the bottom before moving upwards, thereby causing damage to the habitat. Little objective data has been collected on the problem of fishing gear impact on the coral habitats, and the effects mentioned above are indicative of a possible situation in SSMR area. A detailed survey aimed specifically at this problem would be necessary before any management decision be taken.

6.2. Dependence of the fishermen on the fishing within the Marine reserve area

Since one of the objectives of the Scotts Head/ Soufriere Marine Reserve is to manage together the different uses of the bay, it is important to know to what extent the various users depend on it for their economic activity. The degree of dependence of the fishermen of Scotts Head and Soufriere can be assessed in two steps. Firstly, their living does not rely only on the resources of the bay : it is estimated, by analogy with neighbouring sites, that about half of their fishing activity takes place in the open sea in the offshore pelagic fishery. This very important assumption should be confirmed by reliable data collection. Secondly, their dependence on the fishing activities within the bay may

imply different potential interactions with the management of the Marine Reserve. According to the management decisions taken, the impact may concern the demersal fishery (if some protection of the habitats is given priority) or the coastal pelagic fishery (if yacht mooring is allowed). The relative importance of these components in the landings (inputs for the local consumption of fish) and in the activity (cost incurred and time spent by fishermen) should be taken into consideration in the decision-making process.

The number of fishermen involved in any management option, and the distribution of their individual fishing activity are other important data to consider. The activity of most fishermen within the SSMR area seems to rely on the use of a single (or highly predominant) fishing technique, which means that any decision concerning one component of the fishery will likely affect very much some fishermen and very little the other ones. In this respect, the seine fishermen are more numerous than any other category. Generally speaking, it is not known how many SSMR area fishermen also fish offshore during the high pelagic season and to what extent (individual degree of dependence on the bay). This could also justify some complements of information by a socio-economic survey.

6.3 Coexistence of the different users of the bay

The zoning of the area which has already been done has helped in a significant way to minimize conflicts among the users of the bay. The fishermen have in principle agreed to use the fishing priority area for their activities and scuba divers, snorkellers and swimmers are using their designated areas. A problem still remains with anchoring of yachts which poses two problems : (1). damage to sea bed and benthic ecology; (2). hindrance to seining activities within the bay. Given the importance of the seine fishery a compromise is necessary between economic and social benefits derived from these two activities. Socio-economic data for the area are not available but would be necessary to adequately assess the mutual impact of the beach seine fishery and the yacht anchoring, and the consequences of management decisions.